

ON THE
TREATMENT
OF
INTRA-THORACIC ANEURISM
BY THE
DISTAL LIGATURE.



BY

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THE patient, Julia W—, upon whom I tied the right subclavian and common carotid arteries simultaneously in the Westminster Hospital, on November 21st, 1865 (*vide* ‘Lancet,’ December 2nd, 1865, and January 5th, 1867), died on December 8th, 1869, from the external bursting of an aortic aneurism. By the patient’s own wish, I was able to have her body removed to the Royal College of Surgeons, where it was carefully injected from the abdominal aorta, and afterwards dissected by Mr. Moseley; and the preparation has been added to the College Museum.

The condition of the patient at the time of the operation was as follows:—There was a pulsating tumour at the inner end of the right clavicle, which was thrust forward. The interclavicular notch, which was obscured by the tumour, could be felt on making deep pressure with the finger.

The pulsation extended above the clavicle and slightly towards the sterno-mastoid muscle. When first seen there was no bruit, but subsequently a faint bruit could be heard. The patient was thirty years of age, pale, but well nourished; she suffered considerable pain in the tumour at intervals, was unable to assume the horizontal position without distress and dyspnœa, and had some difficulty in swallowing. The right radial pulse was smaller than the left.

The patient was examined by numerous physicians and surgeons of eminence, and the almost unanimous opinion was that the aneurism affected the innominate artery, though there was some difference as to whether or not the aorta was slightly involved in addition. In the week during which the patient was in the hospital under observation the tumour decidedly increased, the pressure symptoms became aggravated, and pain with numbness in the right arm came on. Under these circumstances, and believing the aneurism to be one of the innominate artery, I tied the right subclavian artery outside the scalenus, and the right common carotid artery above the omo-hyoid muscle, on November 21st, 1865.

In determining upon tying the two main arteries simultaneously in this case, I was influenced very considerably by the arguments employed by Mr.

Erichsen in his work on Surgery, wherein he shows that obliteration of *one* of the main trunks, whether by disease or ligature, has never been sufficient to effect the cure of the aneurism—except, indeed, in Mr. Evans's case, where, however, the cure depended probably upon inflammation extending to the sac. Supposing each of the main trunks to receive one third of the whole volume of blood passing through the innominate, the obliteration of one of them will still leave two thirds of the amount passing through the aneurism. But in addition to this, there should, I think, be taken into consideration the fact that the stream must be sent with more force through the carotid and subclavian trunks, which are the continuations of the main vessel, than into the branches of the subclavian which come off at right angles, or nearly so, to the main current. Thus, I am not surprised to find that even when the subclavian and its branches have become obliterated, the carotid being pervious, the aneurism continued to make progress; as in a case of Dr. Herbert Davies, reported in the 'London Hospital Reports,' vol. i, where the aneurism eventually burst into the trachea. By cutting off the two main streams, however, and limiting the flow of blood to the branches of the subclavian artery, it appeared probable that a cure might be effected,

not by the entire obstruction of the innominate artery, but by the deposit of fibrine within it and the aneurismal sac, so as to arrest the disease.

Mr. Wardrop believed that the carotid was already obliterated in the case on which he first tied the subclavian for innominate aneurism; and had it been so, the result might have been different; but, as the tumour diminished, the carotid being relieved from pressure, began to beat again, and the aneurism to make progress. In an unpublished case, which M. Paul Broca has kindly communicated to me, and in which he tied the subclavian for an innominate aneurism in August, 1862, the carotid was thought to be obliterated, but proved not to be so at the patient's death in the following February, the vessel being much displaced by the pressure of the tumour, and being reduced to about half its size. In this case, however, pulsation never returned in the vessel, which was obstructed, though not obliterated; and the case therefore resembles one of simultaneous ligature of the two main trunks. The death of the patient was caused by gangrene of the lung, and was in no way attributable to the aneurism, which was filled with fibrinous clot, leaving a cavity in the centre of the size of a small fowl's egg, communicating above with the carotid and subclavian, and below with the aorta. This last case may

fairly be considered a cure as far as the aneurism is concerned (though M. Broca himself speaks of it as a "half-cure" (*demi-guérison*), and it may be classed with Mr. Fearn's well-known case in which he tied the common carotid in 1836, and the subclavian artery in 1838.

Mr. Fearn's patient was a woman aged 28, who presented a pulsating tumour immediately above the sternum, which was evidently making considerable pressure upon the trachea, producing great dyspnœa. A loud bruit was present in the tumour, and extended towards the carotid; the right radial pulse was much smaller than the left. Pressure on the right carotid artery diminished the tumour and relieved the dyspnœa; pressure on the subclavian artery increased the dyspnœa. Mr. Fearn tied the right common carotid artery on the 30th August, 1836. The patient made a good recovery, and was sent home on September 27th, when the tumour was diminished, but still pulsated. The patient was able to walk out daily, the difficulty of breathing being entirely removed, and only returning slightly if she walked fast.—('Lancet,' 15th October, 1836.)

The patient came under Mr. Fearn's care again in July, 1838, when she had a cough, and suffered from dyspnœa, particularly on any exertion. When quiescent there was no appearance

of tumour in the site of the former swelling, but by pressing the finger forcibly behind the sternum, or the sternal end of the clavicle, a pulsation was felt, and on applying the stethoscope a double sound as of the heart was heard, and a slight bruit. The bruit was very distinct in the supra-clavicular space, and slightly so below the clavicle. The right radial pulse was still smaller than the left. Mr. Fearn tied the right subclavian artery beyond the scaleni on the 2nd of August, 1838. Ten days after, she had no difficulty of breathing and scarcely any cough. There was no bruit either above the clavicle or elsewhere. The respirations were normal.—(‘Lancet,’ 25th August, 1838.)

The patient died on 27th November, 1838, of pleurisy, after ten days’ illness. The innominate was found to be the seat of disease; it presented a globular tumour, an inch and a half in diameter, pressing upon the front and right lateral portion of the trachea, about an inch above the bifurcation, so as to lessen its diameter about one third. This tumour, with the exception of a channel of the usual calibre of the innominata, was completely filled with a dense organized light-coloured fibrinous coagulum. The coats of the diseased artery had given way on their external and posterior wall. The right common carotid was per-

meable for about a third of an inch from its origin, and opposite the lower border of the cricoid cartilage there was an interruption to its continuity, where the ligature had been applied in the first operation. The separated portions of the vessel, which were distant from each other about a quarter of an inch, were connected merely by cellular membrane; the upper portion of the vessel was impermeable to the point of bifurcation. The branches of the thyroid axis were considerably enlarged; the subclavian was obliterated at the outer margin of the scalenus anticus.—('Lancet,' 15th December, 1838.)

The above report is extracted from Mr. Fearn's own account in 'The Lancet.' The tumour, which was exhibited by me to the Pathological Society of London, on November 20th, 1866, consists of a sacculated aneurism, springing from the outer and back part of the innominata, close to its origin from the aorta, and very slightly involving that vessel. The aperture of the aneurismal sac has a diameter of exactly an inch in the side of the innominata, and above it a little more than half an inch of healthy artery intervenes between it and the bifurcation of the vessel. The sac appears to be divided into two portions, one projecting prominently by the side of the artery, and the other pressing backwards against the trachea,

the calibre of which it considerably narrows about half an inch above the bifurcation. The sac is filled to nearly the level of the orifice with a dense fibrinous coagulum, the structure of which is seen to be distinctly laminated at a point where, by the original incision opening the vessel, a small portion has been cut off. The superficial layer of the coagulum is soft and glistening, and appears to be continuous with the lining membrane of the artery around the entire circumference of the orifice of the aneurism except at the lower part, where it has been accidentally detached, carrying with it a small portion of the fibrinous clot.

The right subclavian artery is normal up to the point of ligature (beyond the scalenus) where it is obliterated, and the dense obstructed ends of the vessel are then clearly seen. The branches of the subclavian are pervious, and somewhat dilated. The right carotid is normal up to the point of ligature, and here the vessel is replaced by a fibrous cord. The section of the vessel, half an inch above this, shows it to be completely obstructed. The left carotid comes off close to the aneurism and is healthy, and the left subclavian also is normal. The aorta is slightly dilated, and extensively affected with atheroma in patches.

The accompanying drawing of the specimen (now in the Museum of the College of Surgeons of England) is taken by permission from the 'Transactions of the Pathological Society of London,' vol. xviii.

My patient, Julia W—, made a perfect recovery from the operation. Pulsation returned in the right temporal artery on the night of the operation, and in the brachial two days after. There were never any head symptoms. The tumour did not alter in size immediately, but two days after the operation the patient was able to lie down with perfect comfort; and by the third day the tumour had decidedly altered, the pulsation could not be so distinctly felt, and there was a distinct double beat, but no bruit. By the sixth day after the operation the tumour had so much diminished that the outline of the inner end of the clavicle and upper margin of the sternum could be clearly defined, the pulsation being felt both above and below the bone. By the ninth day pulsation in

PLATE I.

a. Aorta. *b.* Dilated portion of aorta. *c.* Exterior of a portion of innominate aneurism. *d.* Division of right carotid by ligature. *f.* Right pneumogastric nerve. *g.* Left carotid. *h.* Left subclavian. *i.* Opening of innominate aneurism. A small portion of clot projects through the opening, and close to the margin an accidental section of laminated fibrine is seen.

the upper part of the tumour had nearly disappeared. On the eighteenth day both the ligatures came away without any hæmorrhage. Attempts were made to favour the deposit of fibrine in the aneurism by the administration of the acetate of lead, by the application of ice to the tumour, and by careful regulation of the diet, but without any material advantage. The patient was discharged from hospital on March 6th, 1866, three months and a half after the operation, in good health, with no symptoms referable to the aneurism, which was now apparent only by a pulsation through a hole in the upper part of the right side of the sternum, and not in the sterno-clavicular joint as had been at first supposed. The right radial pulse was feebly perceptible, and the circulation on the right side of the neck fully restored.

The next thing I heard of Julia W— was that she had been admitted into St. Bartholomew's on Sunday, April 8th, dead drunk. I visited her on the 11th, and found that the tumour had diminished slightly since she left the Westminster Hospital; certainly it had not increased. The pulsation appeared the same as before.

I heard nothing further until I learnt from Mr. Hill, of the Royal Free Hospital, that Julia W— had been brought there by the police, intoxicated, on May 10th. I visited her and found a murmur

at the apex of the heart, which was not present before, and fancied the tumour to be slightly more prominent. Mr. Hill informed me that Julia W— had been a nurse in the hospital four years and a half before, when she suffered from an attack of rheumatic fever with heart affection, and that when she left the hospital a loud mitral murmur could be traced from the apex of the heart to the axillary region. She was in the Royal Free Hospital until August 8th, under Dr. Cockle, to whom I am indebted for the following notes of her condition :—

“The chief feature of interest in the progress of the case while in hospital was the variation in the size of the tumour; it sometimes being quite flat, with scarcely any perceptible impulse, at other times becoming round and prominent, with strong impulse which could be both seen and felt. Sometimes the impulse gave a liquid, at others a solid impression. When the tumour made any sudden alteration in size it was invariably preceded by a burning throbbing pain, increase of temperature, inability to lie on the back, and a sense of suffocation, with more or less vomiting, laryngeal voice, and pain in the shoulder, face, and side of the head of the right side. These remarks refer particularly to the periods of increase only of the tumour, the decrease being

unattended with any symptoms of distress. She had rheumatic pains in the limbs from time to time, which were relieved by iodide of potassium. The cardiac murmur never entirely disappeared. The right ulnar pulse was for the first time discovered on July 5th. She left the Royal Free Hospital on August 8th, when the tumour was small and flat, and the impulse very slight. The treatment adopted consisted in absolute rest, the arm being kept in a sling. Opiates were given, and sedative local applications used to relieve pain."

Julia W— was next heard of at St. George's Hospital, where she was taken by the park-keepers, who had found her insensible in the park. She was suffering from great difficulty of breathing when admitted, but soon recovered, and only stayed in the hospital two days.

I then quite lost sight of my patient until the 8th of November, when, being informed that she was in the custody of the police for being intoxicated, I procured her admission into the Westminster Hospital, and had the satisfaction of bringing her before the Fellows of the Royal Medical and Chirurgical Society on the 11th of December, 1866. On her re-admission to the hospital, a year after the operation, I found that the tumour had decidedly diminished both in size

and in distinctness of pulsation, though the hole in the sternum could still be felt, and it was here that the most prominent pulsation existed. The clavicle was not so much displaced as before. The woman appeared in very good health; her appetite was good, she could walk about without distress, and could lie down with perfect comfort. She said that she had occasional attacks of dyspnoea, and that these came on when she had been drinking; and this accounts for her visits to other hospitals. There was no bruit to be heard in the tumour, nor any abnormal sound in the heart.

J. W— continued to lead a very irregular life, and was taken by the police to almost every hospital in London; but the disease underwent no material alteration until about two years after she was under my care, when the resident officer of one of the institutions to which she was taken when overcome by drink, unfortunately administered powerful emetics to her, not being aware of her condition. After this the tumour, which could before be felt beating through the sternum, became much more prominent, and gradually increased in size until the skin became involved and discoloured. I procured her admission into the St. Elizabeth's Hospital some months before her death, and she received there every kindness and attention from the authorities and from Mr.

Tegart, the visiting surgeon. She then complained of constant pain in the aneurism, which was relieved by the local application of morphia, and had occasional attacks of dyspnœa and prostration. A month before her death, there having been for some time a large ecchymosis over the tumour, an arterial bleeding occurred, but this was checked by styptics. Bleedings occurred from time to time, and at last, on December 8th, 1869, she died, after a copious hæmorrhage.

On *post-mortem* examination the innominate artery was found to be healthy, except that it was somewhat enlarged at its origin. The arch of the aorta was extensively aneurismal. Immediately above the pulmonary artery the aorta was dilated, and presented a double pouch to the right side. Immediately above this, and extending up to, but not involving, the origin of the innominata, was the origin of the sac of the aneurism which had burst through the sternum; and externally, in front of the manubrium, was the thin-walled sac full of soft coagulum, which had given way toward the left side above. On opening the aneurismal tumour within the thorax, it was found to be a distinctly sacculated aneurism, springing from the right side of the ascending portion of the arch of the aorta, higher than appeared externally, owing to the lower part of the aneurism having grown

downwards, and to the right. This portion of the sac contained firm, laminated fibrine, to the thickness of one third of an inch. The portion of the aneurism attached to the sternum contained no fibrine, except the loose clot in the outer sac. The subclavian artery was reduced to a fibrous cord, one inch in length, immediately outside the scalenus, and the right common carotid was obliterated in the whole of its course, the point of ligature being marked by a delicate fibrous cord, and the upper inch and lower two inches of the vessel forming a flat fibrous band, nearly one fourth of an inch wide.

The carotid sheath was natural, the *descendens noni* nerve passing within it; the jugular vein and pneumogastric nerve were also normal. The collateral circulation through the vessels of the neck and arm was found to be fully established, being carried on principally by a large *transversalis humeri* or *supra-scapular* artery coming off from the thyroid axis, and anastomosing with a large *dorsalis scapulæ* artery. There was also an ordinary sized *transversalis colli* arising from the third part of the subclavian, immediately to the inner side of the point of ligature. The inferior thyroid and vertebral arteries were natural, but an additional branch rose by the side of the vertebral, and passed backwards to the muscles.

The right internal mammary was enlarged, and so also the intercostals meeting it, but the lateral intercostal branches were no larger than usual.

The preparation was brought before the Pathological Society of London on April 19th, 1870, and the accompanying drawing of it (Plate II) is taken by permission from the 21st volume of the Society's 'Transactions.'

The preceding case appears to raise a very important question in practical medicine and surgery—whether, in cases of aneurism of the arch of the aorta, it is not possible to afford relief by surgical interference. There can be no question that my patient's urgent symptoms of dyspnœa and dysphagia were relieved by the double ligature, and that her life was prolonged very considerably under the most untoward circumstances. Dr. Cockle has already ('The Lancet,' April 10th, 1869) urged ligature of the carotid in cases of aortic aneurism which are making progress in spite of medical treatment; and when the disease involves the left side of the arch, I should be inclined to follow the suggestion as regards the *left* carotid. But when the disease involves the

PLATE II.

A. Aortic sac. B. Sac in front of sternum. C. Innominate artery. D. Left clavicle.

right side of the arch, I believe the only hope of success will be in tying both the right carotid and subclavian, so as to diminish as far as possible the current through the innominate, agreeing as I do with Dr. Sibson in the importance of attacking the vessel next to the aneurism.

In reference to the cases of distal ligature, quoted by Dr. Cockle in his valuable paper already referred to, I may remark that both the cases of Tillanus and Rigen, in which cure of an aortic aneurism followed ligature of the carotid, were examples of ligature of the *left* carotid, the aneurism being on the transverse portion of the arch. In Montgomery's case the ligature was also on the *left* side, and the aneurism was found four months after the operation to involve the aorta between the innominate and left carotid arteries, thus supporting the view I have put forward above. In Mr. Maunder's case, in which he in 1867 followed my example of tying the two arteries on the right side for supposed innominate aneurism, the disease proved to be principally aortic, and the coagulation had extended down to the heart, and thus occasioned death. In my own case, the aneurism being more distinctly sacculated, this untoward result did not occur, nor is it to be necessarily anticipated in another case.

Since the above was written a case has come under my care at University College Hospital, in which I thought it advisable to attempt to tie the subclavian and carotid arteries for an aneurism of the arch of the aorta, simulating an innominate aneurism, but was foiled by the fact that the sac of the aneurism had so encroached upon the posterior triangle of the neck as to completely overlies the subclavian artery and render it impossible to secure it. The patient was a man aged 45, a railway porter, who had had aneurismal symptoms for over nine months. On admission there was a swelling occupying the inner half of the right clavicle, and reaching beyond the notch of the sternum; it extended an inch and a half above the sternum, and had expanded the clavicle and thrust forward the sterno-clavicular joint. An indistinct pulsation was audible in the tumour, but there was no thrill or *bruit*. On percussion there was absolute dulness over the tumour, and imperfect resonance to the first rib in front, while behind the dulness extended over the upper third of the scapula. The heart sounds were normal. The *left* radial pulse was imperceptible, the brachial was felt faintly but much less than the right. Both jugulars were distended, and a plexus of veins was visible on the right side, but not on the left. There were

both dyspnœa and dysphagia. The disease was diagnosed as probably innominate aneurism involving the aorta, and the patient was transferred to my care for operation.

On September 14th, 1870, I proceeded to cut down upon the third part of the right subclavian artery, intending to tie both it and the common carotid. In dissecting down upon the artery I was much inconvenienced by the large veins; one of these happening to be divided low down gave great trouble, and led to considerable loss of blood, as it was found impossible to tie it, and consequently it was held by the finger of an assistant. I experienced great difficulty in finding the artery, as the parts were altered and obscured, and none of the usual guides to the vessel could be felt; and at last, after a tedious dissection, I came upon a pulsating sac in the position of the artery, which appeared to be the aneurism extending much further than was anticipated. Under these circumstances it was of course impossible to proceed, and the wound was closed, being plugged with lint soaked in perchloride of iron, in order to check the venous oozing. The patient went on well till the fourth day, when he had a violent attack of spasm and difficulty of respiration. On the fifth day the plugs were removed without any bleeding, but in the evening a sharp hæmorrhage

took place and the wound was plugged. No further bleeding took place, but the patient died on the evening of the next day.

At the *post-mortem* examination a large sacculated aneurism of the aorta was found rising close to the origin of the innominata, in front of which it was lying. The left subclavian was found to be obliterated about two inches from the aorta, but the innominate and left carotid were pervious. The right subclavian occupied its usual position, but was completely hidden by a portion of the sac of the aortic aneurism, which reached into the posterior triangle, and was the part seen during the operation. It was this which ultimately gave way, causing the secondary hæmorrhage.

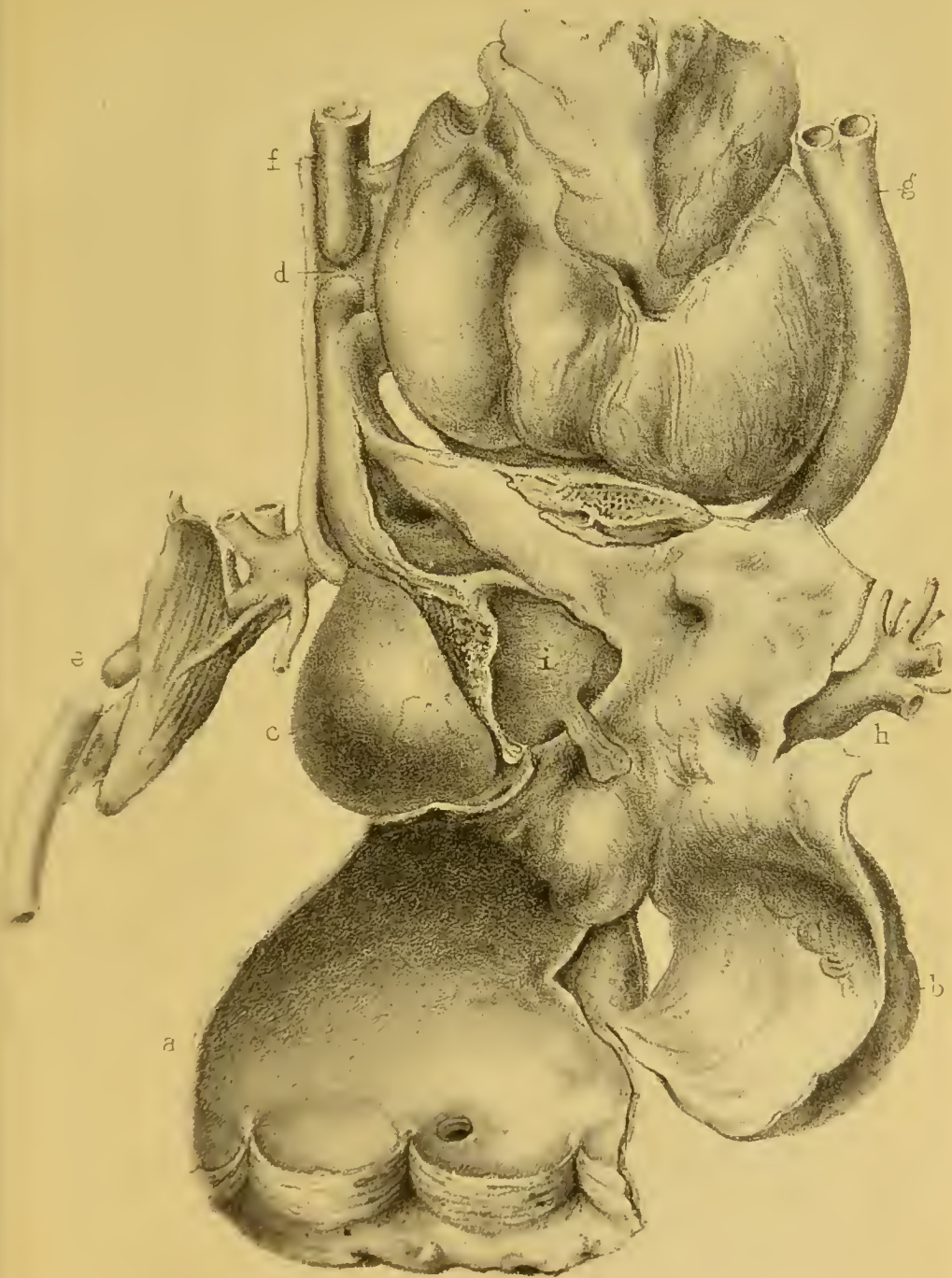
This case appears to me to be of great interest as bearing upon the question of the treatment of aortic aneurism by the distal ligature, when taken in conjunction with the two preceding cases. The patient in the last case was in as dangerous a state as was Julia W—, and might have died at any moment from bursting of the sac. Under these circumstances I had no hesitation in endeavouring to apply a distal ligature to the right subclavian and carotid arteries, believing, it is true, that the aneurism involved the innominate as well as the aorta, but, for the reasons given above, being prepared to adopt the same treatment, could it have

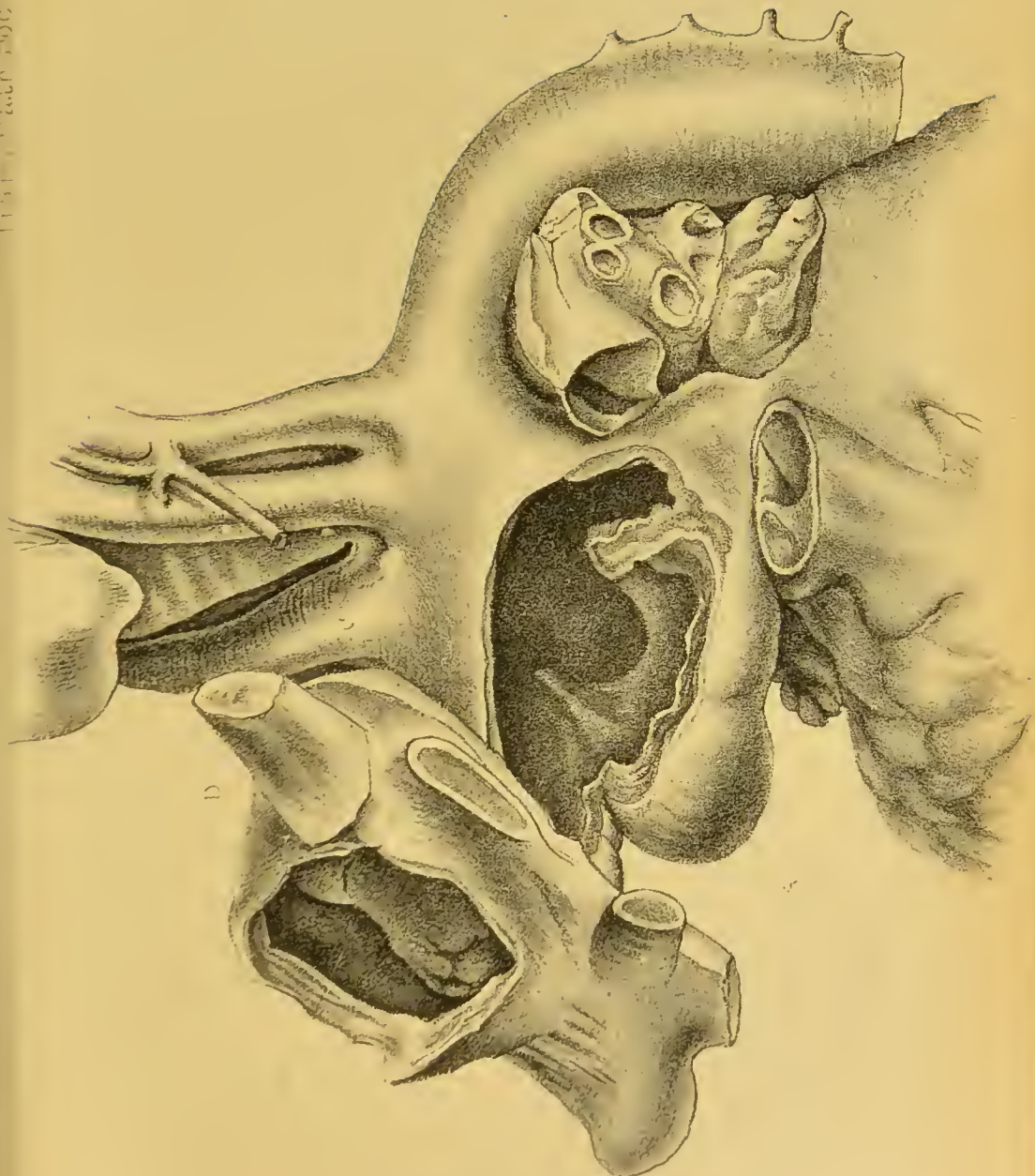
been possible to demonstrate that the aorta alone was involved. The relief afforded by the double ligature, in the case of Julia W—, was so marked as to justify the proceeding in similar cases, in my opinion, though the difficulty of diagnosis must necessarily be extreme in every case. The relief to dyspnœa and other urgent symptoms, experienced also in Mr. Fearn's and M. Broca's cases, is most encouraging, and there can be no doubt that in the former a complete cure was effected. The extension of the aneurismal sac into the posterior triangle of the neck, as in my last case, must be extremely rare, and should not form an argument against the operation.

Before quitting the subject it may be well to note that in two cases, at least, distal pressure has given relief in aneurisms of the root of the neck probably involving the aorta. In the 'Edinburgh Journal' for October, 1847, p. 229, there is a report of a case, by Dr. Lyon, in which the patient had a large aneurism, of the size of the fist, reaching upwards from the sternum, on the right side. Pressure on the carotid was made at intervals, and the tumour became more solid. The patient was of intemperate habits, and died of bursting of the sac into the pleura after twenty months. The aneurism was found to involve the innominate and aorta. There was a large fibrinous deposit oppo-

site the attachment to the right sterno-clavicular joint, and the other parts of the sac were filled with soft coagulum. In the 'Lancet' of January 9th, 1858, the late Mr. A. M. Edwards, of Edinburgh, has recorded a case of supposed innominate aneurism in a woman of fifty, in whom Dr. Laycock pronounced the aorta also to be implicated, and in whom great relief of all distressing symptoms was procured by the adaptation of pressure to the right common carotid and subclavian arteries. Unfortunately the termination of the case and *post-mortem* appearances have not, so far as I know, been published.

In Mr. Holmes's valuable article on Aneurism ('System of Surgery,' vol. iii, p. 576) will be found a table of all the cases of distal ligature for aneurisms of the root of the neck with which I am acquainted, with references to the original account of each.





10

